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OBSERVATIONS CONNECTED WITH THE OCCULTATION OF 7 *Aquarii* BY *Venus*, 1918 MARCH 2 G. M. T.

AT THE LICK OBSERVATORY, MT. HAMILTON

On the 28th of February the observatory received a cablegram from Dr. C. E. Adams, Wellington, New Zealand, in which our attention was drawn to the fact that an occultation of the star 7 *Aquarii* by *Venus* would take place the 2nd of March, 2^h G. M. T., duration 2 hours. Both the immersion and the emersion could be very favorably observed here; the immersion taking place 1½ hours after *Venus* rose and 16 minutes before sunrise, the emersion of course in full daylight, yet early enough that tolerable seeing might be expected. The more accurate examination of the circumstances of this phenomena by help of the data in the *American Ephemeris* and Boss's *Preliminary General Catalogue*, taking account of the parallactic displacement of *Venus*, showed the disappearance to occur at $2^h25^m.4$ G. M. T. near the south cusp of *Venus* and on the dark preceding limb, the reappearance at $4^h38^m.2$ G. M. T. near the north cusp and fortunately also on the dark limb. The big apparent diameter of *Venus* 50″ (63″ is maximum) and its slow motion near the stationary point are also favorable for the accuracy of the results. Some information about the atmosphere of *Venus* might also be gathered from the variation of the brightness of the star near the dark borders. On the average the occultation of a star brighter than 6th magnitude by *Venus* is likely to be observed once every 10 years; of a star brighter than 7th magnitude every 2.5 years.

The phenomena were observed at both the 36″ and the 12″ refractor. Dr. Aitken previously made the following micrometrical measures at the 36″:

SIDEREAL TIME, MT. HAMILTON

16^h	14^m	49^s	position angle of	south	horn	at	star	18°.90		2	settings			
16	15	59	"	north	"	"	"	2 .62		2	"			
16	20	46	distance of	south	"	from	"		10″.80	4	"	in position angle	18°.85	
16	22	37	"	north	"	"	"		58 .09	4	"	"	18 .85	
16	26	39	"	south	"	"	"		7 .56	5	"	"	18 .85	threads difficult to see
16	29	04	position angle of	south	"	at	"	26 .85		2	"			
16	30	32	"	north	"	"	"	2 .15		2	"			
16	33	17	distance of	north	"	from	"		56 .14	4	"	in position angle	1 .85	dark threads
16	37	05	position angle of	north	"	at	"	4 .10		2	"			dark wires
16	38	09	"	south	"	"	"	52 .45		2	"			
16	40	03	distance of	south	"	from	"		5 .90	3	"	in position angle	51 .85	
16	42	04	"	north	"	"	"		54 .19	3	"	"	1 .85	

Wind troublesome in all the measures.

Dr. Campbell then observed the disappearance at the 36″ as follows:

SIDEREAL TIME								
16^h	53^m	$55^s.8$	star	certainly fainter	corresponding G.M.T.	2^h	22^m	$16^s.5$
16	54	16 .8	"	gone but reappeared	"	2	22	36 .4
16	54	43 .3	"	certainly gone	"	2	23	02 .9

Remarks written by Dr. Aitken: "Star began to diminish about $16^h53^m19^s$ or perhaps 10^s earlier. Diminished slowly until it abruptly disappeared, then kept alternately appearing and disappearing. Certainly $1\frac{1}{2}^m$ from time decrease in brightness was noticed until it finally disappeared. W. W. Campbell at telescope, seeing satisfactory; star image sharp and round; limb of planet fairly steady. Wind troubled in all my micrometer settings."

Dr. Moore observed the disappearance of 7 *Aquarii* with the 12″ refractor on the south preceding side and occulted by dark portion of *Venus*:

PACIFIC STANDARD TIME				
6^h	13^m	20^s[1]	A. M.	star looks fainter and getting fainter.
6	14	32		" fainter
6	15	00		" straight with horn
6	15	20		" still fainter
6	16			seeing very poor
6	19			" " "
6	20			star still there and fainter
6	21	31.5		" disappears for a moment
6	21	48.5		" gone
6	21	57.5		" very faint; faint line along limb by star and horn
6	22	04.5		" very, very faint
6	22	20.5		" gone.

The reappearance was observed by Dr. Campbell at the 36″ refractor. Sidereal Time $19^h08^m56^s.8$, corresponding G. M. T. $4^h36^m54^s.5$.

Remark: After reappearance Dr. Moore looked in the telescope and then again Dr. Campbell looked at the star and found it noticeably brighter.

The reappearance was observed by Thiele at the 12″ refractor on the north preceding side P. S. T. $8^h36^m40^s.8$ A. M., corresponding G. M. T. $4^h36^m40^s.8$. Seeing immediately afterwards very poor, had to wait 30^s before the star could be seen again.

Professor Tucker observed the right ascension of *Venus* at meridian transit, following the occultation of 7 *Aquarii*. The observed right ascension of the following limb, $20^h52^m31^s.44$, has been reduced to the center of the planet, with the correction for the semi-diameter, $25''.7$, from the *American Ephemeris*. The resulting correction to the tabular right ascension of *Venus*, from the *American Ephemeris*, is $+0^s.09$.

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[1] Since Pacific Standard Time is 8 hours slow of Greenwich Mean Time, Greenwich Mean Noon occurs at 4 A. M., P. S. T., and the G. M. T. corresponding to the times recorded are 2h13m20s., etc.—Editors.

Irradiation may be responsible, to some extent, for the plus correction. But, observed in full daylight, less than two hours before noon, the effect of irradiation of the limb of the planet must have been comparatively slight.

The observed times of disappearance and reappearance are respectively $2^m.5$ and $1^m.5$ earlier than those computed from the data in the *American Ephemeris*; in correcting these data the following points may be considered: The diameter of *Venus* must be looked upon as not certainly known, for the values adopted by the astronomical almanacs vary between $50''.4$ and $52''.7$. The smallest value for the diameter is that determined from measures of *Venus* as a dark disc projected on the Sun; the values determined outside the Sun are all larger, the more so the darker the background of the sky; this can be accounted for by the combined effect of *Venus's* atmosphere and the irradiation. The uncertainty of the star place affects the phenomenon with its full amount, but the star is well observed and the mean error in the place about $\pm 0''.3$; the 12^m companion $2''$ distant in 166° was not noticed during the observation. The uncertainty of the position of *Venus* enters principally as an error in the heliocentric longitude; the corresponding variations in R. A. and Decl. have to be introduced together.

For different assumed corrections to the place of the *Venus* a table over the square of the distance between the star and *Venus* as it would have been observed was formed and interpolated nearly as a second power function of the time. Assuming the disappearance to have taken place at $2^h23^m.0$ M. G. T. and the reappearance at $4^h36^m.7$ the correction to the place of *Venus* was determined as $-2''.0$ in R. A. and $-0''.8$ in Decl. and to the diameter as $50''.2$. The influence of the place correction and the diameter correction on the time of disappearance is nearly equally great, whereas the influence of the place correction on the time of reappearance is very small and the diameter correction therefore well determined and separable from the former. The corrected place and diameter is pretty close to that of *Connaissance des Temps*.

The reduction of the micrometrical measures of Dr. Aitken, considering the star moving with the opposite motion of that of *Venus*, gives for each horn 3 lines of direction and 3 lines of distance. The combined observed places compared with those calculated from the position and diameter determined by the occultation are both further to the west and south, for the north horn resp. 0″.9 and 0″.7, for the south horn 2″.1 and 1″.3. This indicates that the horns extend 2°.5 and 4°.5 beyond the diameter, corresponding to a horizontal refraction in the atmosphere of *Venus* of 40′, accepting Mädler's formula, in good agreement with the value 44′ found by observations in smaller angular distances from the Sun. But if such a value of the refraction were correct the occultation of a star by *Venus* would require a long time; in fact, the star would begin to reappear almost before it had disappeared. The observations show that the fading of the light of 7 *Aquarii* was appreciable for only a few minutes before the star's disappearance; therefore we cannot be dealing with such an amount of refraction but perhaps with some opaque and changing hindrance to the light like high clouds in the atmosphere of *Venus*.

H. THIELE

March, 1918

NOTE ON COMET *b* 1916 (WOLF)

The comet has been slowly receding from the Earth and from the Sun. On March 21st it is about two hours away from the Sun in R. A. Near the beginning of May it passes on to conjunction.

It may be possible to pick it up again after next July, but it will be exceedingly faint. The comet comes again to opposition near the end of November. The brightness at opposition will be only one-tenth what it was on January 8th, when it appeared as bright as a star of the 16th magnitude. The following ephemeris, computed from the elements of *Lick Obsy. Bull.*, 295, will show the region of the sky in which it should be found.

FOR GREENWICH MEAN MIDNIGHT

1918	α	δ
Aug. 12.5	$4^h\ 15^m.4$	+2° 04′
Sept. 13.5	22 .1	−0 16
Oct. 15.5	16 .0	2 57
Nov. 16.5	4 00 .5	5 00
Dec. 18.5	3 44 .7	−5 32

It will be theoretically of about the 18th magnitude, and decreasing in brightness.

H. M. JEFFERS

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